George C. Marshall Space Flight Center
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Baseline
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FACILITY OPERATING PROCEDURE

ED27 / STRUCTURAL AND DYNAMICS TEST GROUP

USE OF OMETRON LASER VIBROMETER FOR DYNAMIC TESTING

CHECK THE MASTER LIST—
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

Signature sheet is on file per ED27-OWI-M&V-001.

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DOCUMENT HISTORY LOG

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USE OF OMETRON LASER VIBROMETER FOR DYNAMIC TESTING

1. SCOPE

1.1 Scope. This document describes the procedure to be used when conducting a dynamic test using the *Ometron VPI Sensor* laser vibrometer.

1.2 Purpose. This procedure defines the specific operating instructions of the vibrometer for compliance with MPG 8730.5.

1.3 Applicability. This procedure applies to all ED27 personnel performing dynamic tests using the laser vibrometer.

1.4 System Description. The system under test consists of the test article, *Ometron VPI Sensor*, electro-dynamic shaker, accelerometer(s) or load cell(s), and data acquisition system.

1.5 General. The Test Engineer shall be responsible for coordination and enforcement of the document activities.

2. APPLICABLE DOCUMENTS

ED27-OWI-M&V-001	***Document Control***
ED27-OWI-M&V-002	***Quality Records Control***
ED27-OWI-M&V-003	***Test Report Control***
MPG 1700.1	***MSFC Industrial Safety Procedures and Guidelines***
ANSI Z136.1	***American National Standard for Safe Use of Lasers***
ED27-CDL-FOP-002	***Calibration of Ometron Laser Vibrometer for Dynamic Testing***
ED27-CDL-FOP-003	***HP3566/PC Data Acquisition for Dynamic Tests***
MPG 8730.5	***Control of Inspection, Measuring, and Test Equipment***

3. REFERENCE DOCUMENTS

Associated Equipment Manuals
Oscilloscope
Data Acquisition System
Electro-dynamic Shaker

Ometron VPI Sensor Operator's Manual

HP 3566A/3567A Operating Reference

4. DEFINITIONS

4.1 Ometron VPI Sensor A non-contact, laser based, sensor which measures the velocity of a solid surface.
4.2 Electro-dynamic Shaker An electromagnetic input excitation source.
4.3 Oscilloscope Currently using a Tektronix TDS640A. Any general purpose oscilloscope may be used.
4.4 Reference input accelerometer or load cell Any calibrated accelerometer or load cell which measures the excitation input acceleration or force.
4.5 Data Acquisition System (DAS) Currently using an HP3566A PC based DAS. Any general purpose DAS may be used. The DAS should have at minimum 2 inputs, one for the vibrometer output and reference accelerometer or load cell and 1 output for the excitation drive signal.

5. SAFETY PRECAUTIONS AND WARNING NOTES

The *VPI Sensor* has a laser output of no more than 1 mW and falls under the category of Class II laser products. Therefore, precautions should be taken to prevent continuous intentional viewing directly in line with the path of the laser beam. The laser beam shall not be aimed at personnel or at head height, and the beam shall be blocked or turned off when not in use.

6. ACTIVATION PREPARATIONS

Prior to test initialization, the test engineer shall:

a. Determine the proper excitation methods, levels, and equipment.
b. Identify and characterize the test article fixtures and support hardware.
c. Determine whether the test article will require surface preparation to ensure adequate laser beam return characteristics and identify the appropriate surface preparation if necessary.
d. Ensure that proper cabling will be used for all test and measurement equipment.
e. Determine the proper *VPI sensor* lens element to be used inside the vibrometer based on the distance from the sensor to the test article.
f. Obtain the proper scale factors for the velocity range settings of the vibrometer and enter these scale factors into the DAS data base.
g. Check to see that the unit is current for calibration and measurement validation. If the unit is not currently in calibration refer to ED27-CDL-FOP-002, *Calibration of Laser Vibrometer for Modal and Vibration Testing*, for calibration procedures.
h. Ensure that the *VPI sensor* unit has not been damaged or tampered with.
i. Ensure that the test area is properly controlled to preclude the possibility of continuous, direct line of sight laser beam exposure to personnel. This may include warning signs of laser use, curtains, and/or movable tape barriers surrounding the test area.

7. PROCEDURE

a. Set up and connect the vibrometer and DAS according to their respective reference documents.
b. Connect the reference accelerometer or load cell to one input channel of the DAS and the *Ometron VPI Sensor* raw output signal to another input of the DAS. Connect the source excitation signal from the DAS to the electro-dynamic shaker.
c. Turn on the laser power supply and all other test and measurement equipment.
d. Aim the laser at a specified measurement point. Using an oscilloscope, monitor the Doppler signal of the laser. Focus the laser on the measurement point until the modulation of the Doppler signal amplitude approaches 10V pk-pk or until the highest amplitude is reached.
e. Initialize a drive point excitation through the DAS and begin frequency or time based measurements using the DAS per ED27-CDL-FOP-003 *HP3566/PC Data Acquisition for Dynamic Tests*.
f. Upon completion of the measurement(s) for this point save the data on appropriate magnetic media. Turn off or disable drive point excitation.
g. Repeat steps d through f until data from all the required measurement points are obtained.
h. Turn off the laser and then turn off power supply to laser vibrometer. Power off all other test and measurement equipment.

APPENDIX A

ED27/MODAL AND CONTROL DYNAMICS TEST TEAM TEST AND CHECKOUT PROCEDURE

VIBRATION & MODAL TEST USING LASER VIBROMETER

FOR

_____

Test Article Name

_____

TCP #

Test Article S/N _____

AXIS_____

Drive Point Measurement Transducer:

Model_____ S/N_____ Scale Factor_____

Inspect the *Ometron VPI Sensor* unit for damage or tampering _____

Connect power supply, turn on laser _____

Scan the laser to a specified measurement point _____

Focus the laser until the Doppler signal amplitudes are maximum or 10V pk-pk _____

Enable the drive source signal _____

Record the data and save to magnetic media _____

Laser velocity range _____

Scale Factor _____

Measurement Point _____

POST-TEST VERIFICATION

The Test and Checkout Procedure _____ has been satisfactorily completed and documented.

_____ _____

Test Engineer Date

_____ _____

Quality Monitor Date